



## WELDING PROCEDURE SPECIFICATION

**WPS #:** 7000-PVC-Fabric    **Rev. No.:** 1    **Date:** 9/11/06    **Applicability**  
**Welding Process:** TF    **and**    TF    SC/SS PVC Architectural Fabric  
**Supporting PQR:** 9302 to 9302    9302 to 9319    9302 to 8028  
Ferrari 702 to  
9032

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### Scope:

This welding procedure is for seam welding and repair of Safety Class/Safety Significant PVC coated architectural fabrics (such as Domes at TA-54). Typical joint configurations are lap seam to join two sheets or a patch which laps over the top of a rip or tear. Patches may be applied to one or both sides of the base fabric as determined by responsible facility operations personnel.

The welding process is Thermal Fusion using Hot Air as the heat source and using the fabric's manufactured coating from two faying surfaces melted together to form the bond on a lap seam or patch.

The Step by step process is detailed below:

1. Equipment - Leister Triac PID Hot Air Tool will be used for the heat source. Misc. tips and rollers may be used as required.
2. Personnel Qualification – personnel who weld or bond PVC fabrics shall be trained and certified as outlined in the PVC Welder Performance Qualification Procedure.
3. Temperature verification- Prior to the start of welding for each shift the temperature of the hot air output shall be measured using a calibrated temperature measuring device.
  - a. Temperature shall be taken with a thermo-couple held approximately one inch from the outlet of the heat source in midstream of the air flow.
  - b. Heat source shall produce and be set in the range of 620° F to 680° F.
4. Process/Workmanship Samples –samples shall be made at the start of each shift or whenever a change in materials or joint configuration is made (patches vs. replacement panel seams).
  - a. Process/Workmanship samples(typically ~4" x~ 12" patch welded in the center of an ~8" x ~16" fabric) will be made in-line with the fabric threads and will be cut and removed to ~1" x ~8" size with one end left loose.
  - b. *Note: The purpose of the workmanship samples is to provide QC (process control) function to verify that adequate welds can be made using current materials and conditions, since there is no acceptable consensus method to nondestructively test actual welding which will be performed in place (in situ).*

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- i. Each sample will be pulled apart to visually verify that the bond between two pieces of coated fabric is as strong as the bond of coating to fabric.
- ii. In addition at least 66% of the faying surface area will be bonded and in no case shall the un-bonded area traverse across the entire faying surfaces.

## 5. Surface Preparation –

- a. Prior to welding the surfaces to be joined shall be cleaned to remove loose dirt, or deleterious materials that could adversely affect the weld area.
  - i. Using Formula 409®, Mr Clean, Fantastik®, Spray Nine, All-Purpose Cleaner or Zep
    - 1. Mix cleaning solution  $\approx$  1:1 with water
    - 2. Apply with sponge, cloth, or spray directly onto vinyl.
    - 3. Allow to penetrate briefly.
    - 4. Rinse or wipe off with damp cloth, or use medium pressure spray gun.

*Note: Make sure to wipe off all cleaner and residue repeat the above procedure as necessary. A mild bleach solution diluted  $\approx$  1:100 with water may be used when fungus is present followed by thorough rinsing to ensure bleach and residue has been removed.*

- b. Surface should be wiped clean with clean dry rag.
- c. Backing for the joint must be put in place. (typically this will be a rigid support such as piece of plywood or masonite)
- d. Tedlar® Coating (film) if used on the manufactured fabric shall also be removed
  - i. Preferred method to remove Tedlar® is lightly sand the surface using a 180 Grit abrasive disk (flapper) or drum.
  - ii. Additionally the Tedlar® may be removed by lightly scoring the film then peeling it from the PVC coating.

*Note: Using either method; care must be exercised to remove only the Tedlar® and preclude removing any PVC coating from the fabric.*

## 6. Fabric Materials –

- a. Materials must be procured, stored and used in a manner such that traceability of manufacture and product type or grade is maintained to the point of use:
  - i. Materials shall be procured with product ID or label attached which identifies the product item number, style, color, grain, grade, width, finish, run number, date, inspector, from roll number, and

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the tag number which incorporates the plant location, run number, and the inspection number.

- ii. Certified Material Test Reports or Certificates of Compliance shall record test results as specified in ASTM D- 751 Standard Test Methods for Coated Fabrics for:
    - 1. Breaking Strength,
    - 2. Adhesion of Coating to Fabric,
    - 3. Adhesion of Welded Joints Test – (Peel Test),
    - 4. Seam Strength Test – (Shear Tensile Test),
    - 5. Tear Strength Test using the Tongue Tear Method.
  - iii. Receipt Inspection shall verify that Certified Material Test Reports or Certificates of Compliance against the original purchase order requirements and manufactures specified requirements.
  - iv. Fabric material shall be stored in a clean, dry, enclosed, and controlled area. Minimum temperature shall be ~40 °F (5 °C) with a maximum temperature of ~140 °F. Materials shall not be in direct contact with concrete floors and shall be stored on pallets or bins segregated by fabric material type and size.
  - v. Fabrics shall be stacked separately and segregated by manufacturer and product type.
  - vi. Wherever possible, different lot numbers or control numbers of a single type of fabric material shall be grouped within the stack or kept on separate shelves.
- b. Materials joined to existing materials will be from the same manufacturer and the same product where possible.

*Note: When fabric of the same manufacturer and type are not available, use material recommended by manufacturer*
  - c. When the seam or patch attaches two materials of different types the new material should be of the heavier or stronger material.

## 7. Joint Assembly and Alignment –

- a. New Seams
  - i. The seam must be fit and aligned such that there is a minimum of 1“ overlap and preferably 1.5” to 2” overlap at the seam.
  - ii. Once fit-up it can be tacked (fused in small areas) with several tacks to hold the fabric in place.
- b. Rips & Patches
  - i. For rips and tears it may be necessary to staple or sew the components to hold the fit-up and alignment while tacking the patch material in place.
  - ii. Staples and thread should be removed where possible.

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- iii. Patches may be attached on one or both sides of the existing base fabric.

*Note: Patch both sides when practical however it may not be possible to patch both sides due to access or other constraints.*

- iv. Patches should be cut such that there is  $\approx 2$ " of overlap on to the existing sound base fabric in all directions.
- v. Patches should be trimmed with rounded corners.

## 8. Welding Technique –

- a. Materials should be heated till the PVC coating begins to produce a slight amount of smoke.
- b. Welding should progress with heating and rolling in a sequenced pattern to bond the two coated surfaces.

*Note: Sequence and pattern will vary with different applications:*

*A typical sequence would be to start from the middle of the patch and proceed from the center out, using roller diagonal in front of the heat gun while moving forward in to the edges.*

- c. The work area for the welding shall be suitably protected from inclement conditions including wind and/or rain.
- d. It is recommended to avoid extremely cold or extremely hot and humid conditions.

## 9. Visual Inspection –

- a. Inspect the welded seam or patch for:
  - i. loose edges, threads, etc.
  - ii. overlaps or creases that would allow liquids to penetrate the joint,
  - iii. Burned or charred fabric or PVC coating,
  - iv. Peeling due to the surface being so heavily oxidized that it would not bond.

**APPROVAL:** Signatures on file at ENG

**DATE:** 10/11/2005